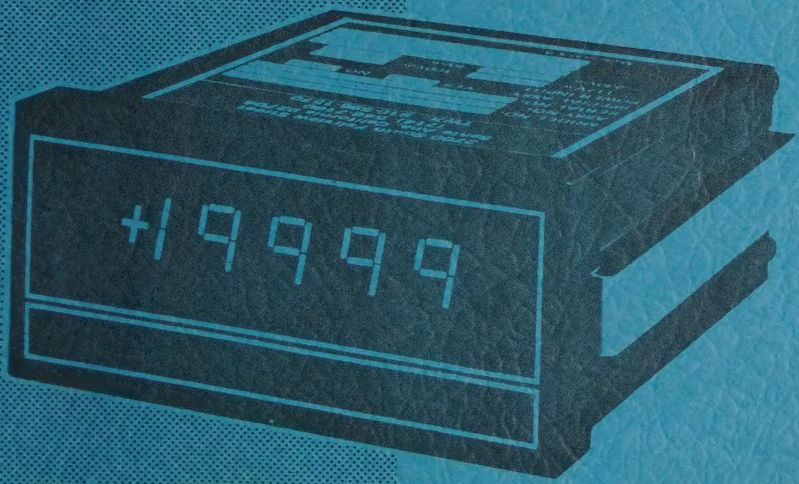
METER ROOM

4½ DIGIT

Panel Instrument

Model 5412



MP MASTER
MA25737

Operation Manual

DATA TECH
A DIVISION OF PENRIL CORP.

Operation Manual

4½ DIGIT

Panel Instrument

Model 5412

P/N 549780 June 1977

DATA TECH
A DIVISION OF PENRIL CORP.
2700 SOUTH FAIRVIEW STREET ■ SANTA ANA, CALIF. 92704

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WARRANTY

Within one year of delivery, we will repair or replace at our option your Data Tech product if any part of it is defective in material or workmanship. Labor is included. Just return the product to us freight prepaid. The card (back page of this manual) should be completed and shipped with the product.

MODEL 5412

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GENERAL DESCRIPTION

The DATA TECH Model 5412 is a 4½ digit, 20,000 count, auto polarity, auto zero, dual-slope panel meter. Four basic units are available, providing either ±200-millivolt, ±2-volt, ±20-volt, or ±200-volt analog ranges. These units are available for operation from 100, 115, 220, and 230 volt AC: and 5 volt DC power sources. The display is by high efficiency light-emitting diodes. See Table 1 for assembly number.

Table 1. 5412 Model Code

5412−X X X

RANGE	POWER	OPTIONS
0 − 200mV FS	0 − 5Vdc	0 − None
1 − 2V FS	1 − 100Vac	1 − Buffered BCD
2 − 20V FS	2 − 115Vac	2 − Isolated BCD
3 − 200V FS	3 − 220Vac	
	4 − 230Vac	

Specifications

PERFORMANCE: After 15 minutes warm-up time, at 25 ±1°C unless otherwise specified.

Temperature Coefficient	(+10° to +40°C ambient)
Zero	Auto Zero
Calibration	±10ppm/°C of scale max, 2V units ±15ppm/°C of scale max, 200mV, 20V and 200V units
Calibration Period	90 days
Accuracy	±(0.005% reading +1 digit)
Linearity	±½ Digit
Common Mode Rejection	>100dB at 50/60Hz
Normal Mode Rejection	>60dB at 50/60Hz
Step Response Time (to rated accuracy)	500mS +1 conversion cycle max.
Input Bias Current	±50pA max (200mV range: 200pA max)
Input Resistance	1000MΩ 2V, 200mV 1MΩ 20V 10MΩ 200V
Maximum Input Voltage	300Vrms
Normal Mode	500Vdc
Common Mode (Ref. to Pwr Supply)	750Vrms 1000Vdc

Specifications (cont.)

ENVIRONMENTAL	
Storage Temperature	-25°C to 85°C
Operating Temperature	0°C to 60°C
Relative Humidity	80% max, non-condensing
POWER	
Operating Voltage Range	
5Vdc	4.5V to 5.5V
100Vac	90V to 110V
115Vac	103V to 127V
220Vac	188V to 230V
230Vac	216V to 264V
Power Consumption (without BCD option)	A.C. Unit - 4W typ. D.C. Unit - 3W typ.
Power Consumption (with BCD option)	A.C Unit - 4.5W typ. D.C. Unit - 3.5W typ.
DIGITAL INTERFACE	
Decimal Point Control Lines	7 TTL Loads/Line
$\overline{\text{Hold}}$ Input Load	1 TTL Load
Output Drive Capability	
Overrange	2 TTL Loads
All other BCD Lines	5 TTL Loads
Triggered Operation ($\overline{\text{Hold}}$ Line) Pulse Width	10μS min. 50mS max.
Opto Isolation (optional)	1000Vdc
GENERAL	
Conversion Time	250mS at full scale
Conversion Rate	2½ ±½ per second
Clock Oscillator	125KHz

INSTALLATION AND OPERATION

Mounting

The meter is designed for mounting in a 1.682 ±.010 by 3.924 ±.010 inch panel cutout. To mount, remove the mounting bracket, position the meter in the panel cutout, and replace the mounting bracket. Do not obstruct the vent slots on either side of the meter case. See Figures 1 & 2.

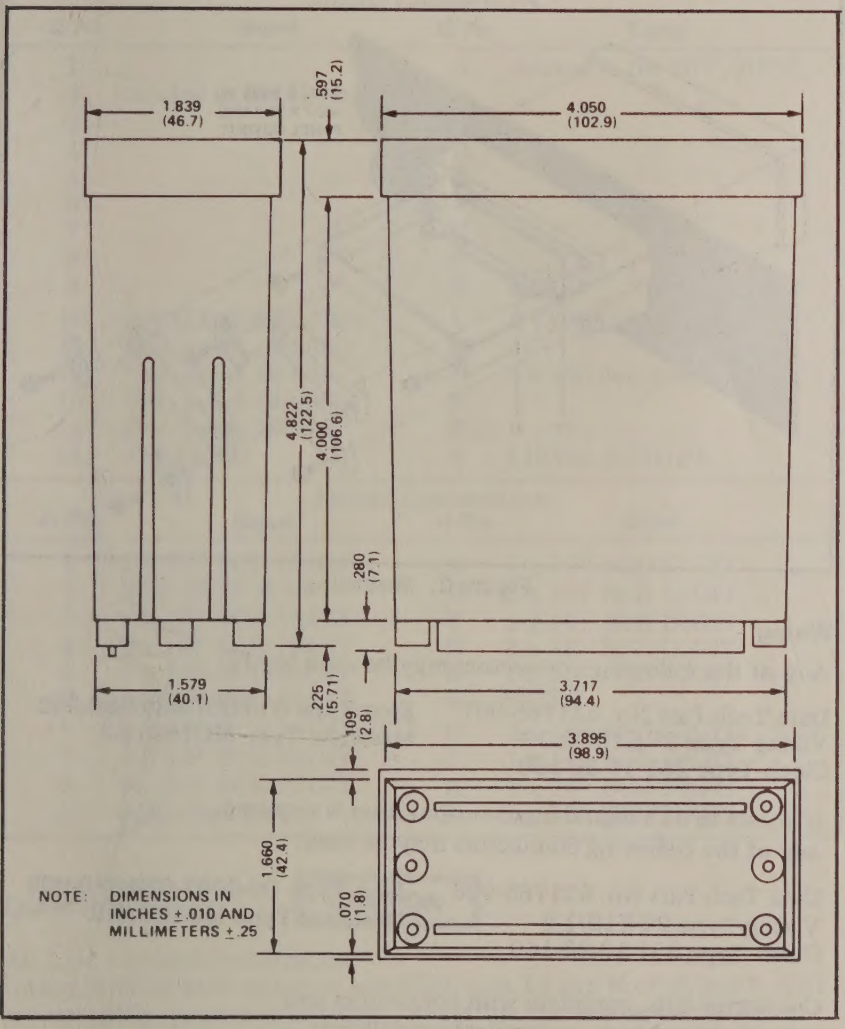


Figure 1. Dimensions

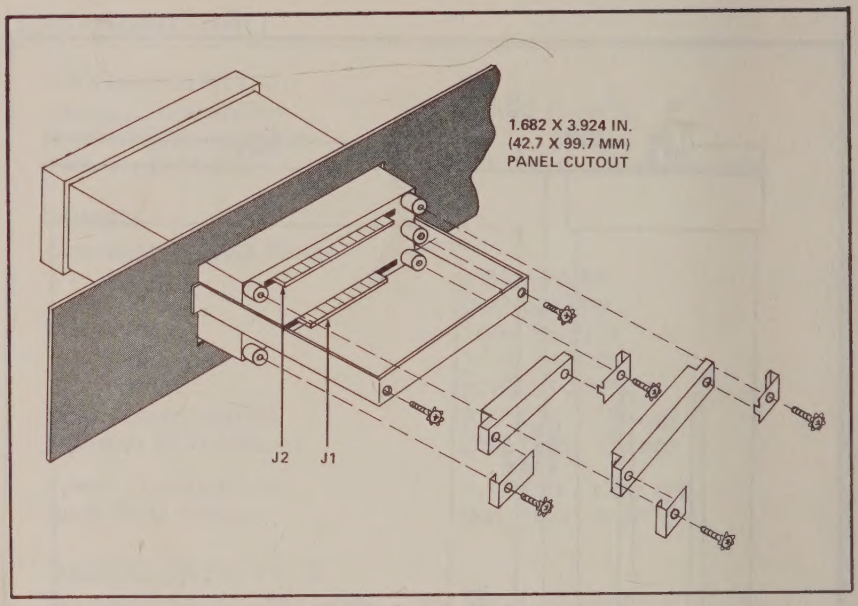


Figure 2. Mounting

Wiring

Any of the following connectors may be used for J2:

Data Tech Part No. 531768-007
Viking Type 2VK15D2/1-2
Cinch-Type 251-15-30-160
Elco Type 00-6007-030-980-002
Masterite-Type MC15D/1-2

If access to J1's digital input-output lines is required, any of the following connectors may be used:

Data Tech Part No. 531768-006
Viking-Type 2VK10/1-2
Cinch-Type 251-10-30-160
Elco-Type 00-6007-020-980-002
Masterite-Type MC10D/1-2

Connector Kits, complete with connectors and mounting hardware, are available as follows:

J1 & J2 (required if BCD option is ordered) Data Tech P/N 549787-001

J2 only (for non-BCD models) Data Tech P/N 549786-001

Using Table 2, connect the appropriate power, connect the source to be measured between the appropriate ANALOG INPUT and ANALOG RETURN, and when applicable, establish the decimal point.

Table 2. Analog and Digital Connections

Analog Connections			
J2 Pin	Signal	J2 Pin	Signal
1		A	Analog in for 20V, 200V
2	Analog in for 200mV, 2V	B	
3		C	
4		D	
5		E	
6		F	
7		H	
8		J	
9		K	$\overline{\text{HOLD}}$
10	ANALOG RETURN	L	OVERRANGE
11	Dec. point 1.8888	M	+5V
12	Dec. point 18.888	N	5V and dec. point return
13	Dec. point 188.88	P	
14	Dec. point 1888.8	R	
15	115Vac HI	S	115Vac RETURN

Digital Connections			
J1 Pin	Signal	J1 Pin	Signal
1	4×10^0 BCD DIGIT	A	1×10^0 BCD DIGIT
2	BCD RETURN	B	2×10^0 BCD DIGIT
3	8×10^0 BCD DIGIT	C	1×10^1 BCD DIGIT
4	4×10^1 BCD DIGIT	D	2×10^1 BCD DIGIT
5	8×10^1 BCD DIGIT	E	1×10^2 BCD DIGIT
6	4×10^2 BCD DIGIT	F	$\overline{\text{PRINT}}$
7	8×10^2 BCD DIGIT	H	2×10^2 BCD DIGIT
8	4×10^3 BCD DIGIT	J	1×10^3 BCD DIGIT
9	8×10^3 BCD DIGIT	K	2×10^3 BCD DIGIT
10	POLARITY (+)	L	1×10^4 BCD DIGIT

Operation

CAUTION

AC Line Powered Instruments:
Unless isolated BCD option is specified, pins 10 and N of J2 and 2 of J1 are internally connected together. Therefore the analog circuit return side must not be at a different potential from the system ground, or damage may result.

DC Instruments have isolation of analog return. Pins J1-2 and J2-N are always internally connected. If the display flashes, an overrange condition exists. Excessive overrange levels can cause damage to the meter. Remove the excessive level immediately–switching off the meter will not protect it from damage.

Hold Mode

A "0" (GND) on J2-K initiates hold mode, whereby, conversions are terminated and BCD and display data corresponding to the last conversion remain stored. When hold mode is initiated during a conversion, the stored BCD and display data will be updated at the completion of the conversion in progress.

External Trigger

Conversions may be controlled externally by the use of the $\overline{\text{HOLD}}$ line. In this mode of operation, the $\overline{\text{HOLD}}$ line is kept at logical "0" and pulsed to logical "1" to initiate a conversion. The required pulse width is specified in the instrument specification section. The relative timing of the trigger pulse, conversion ramp, and $\overline{\text{PRINT}}$ signal is shown in Fig. 4.

THE FOLLOWING APPLIES TO INSTRUMENTS EQUIPPED WITH BCD OPTION:

DIGITAL INPUT-OUTPUT LINES

The digital input and output lines are DTL and TTL compatible, with positive true logic levels as follows:

Logical "1" = +2.4 to +5.5 volts dc with prescribed loads.

Logical "0" = 0 to 0.4 volts dc

Refer to specifications for specific line load capabilities and requirements.

BCD BUFFERED and LATCHED OUTPUT LINES

The 17 lines labeled BCD in Table 2 provide binary coded decimal logic levels representative of the ANALOG INPUT. These lines carry valid data of the previous conversion when the $\overline{\text{PRINT}}$ line is a logical "0".

OVERRANGE Output Line

The OVERRANGE line is normally a logical "0". The line is a "1" for conversions yielding displays greater than ±19999.

The POLARITY (+) line is a logical "1" for positive ANALOG INPUT levels and a logical "0" for negative ANALOG INPUT levels.

$\overline{\text{PRINT}}$ Output Line (Figure 4)

The $\overline{\text{PRINT}}$ line is a logical "1" when the other DATA OUTPUT lines are updating due to a conversion process. The line is a logical "0" when the OUTPUT lines carry valid data.

Calibration

The accuracy of the meter should be established at 90-day intervals. Accuracy is confirmed when known inputs yield corresponding displays within specified accuracy.

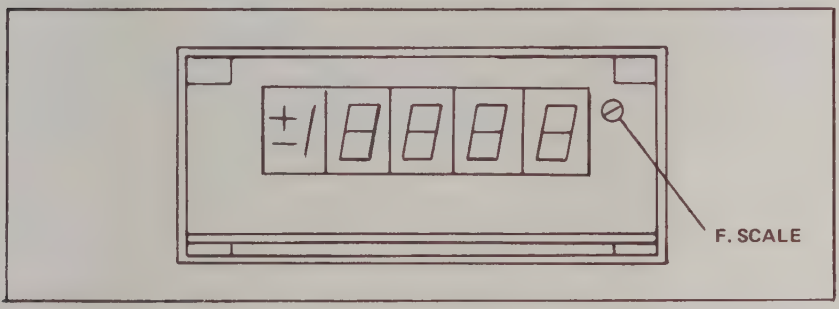


Figure 3. Calibration Adjustment Location

To calibrate, remove the display bezel by inserting a screwdriver in the slot located in the center of the bottom bezel edge. Free the associated retaining tab with a slight downward prying motion of the screwdriver handle. Pivot the lower bezel edge outward and upward for the complete removal. Calibrate as follows:

1. Apply a full scale (19999) input level to appropriate analog input terminals.

2. Adjust the full scale potentiometer for a 19999 display.

3. Replace the bezel by aligning the retaining tabs in front of their respective slots and pushing the bezel until the tabs snap in place.

THEORY OF OPERATION

GENERAL DESCRIPTION (Refer to Timing Diagram & System Block Schematic)

Analog to digital conversion is achieved by the dual slope integration technique. A fixed constant integrator circuit is supplied alternately with (A) the unknown analog signal for a known time period, and (B) the known reference analog signal for whatever time period is required to restore the integrator output to its point of origin. This second period, counted and displayed is the digitized measurement. To update the information, the cycles are repeated by triggers from a multivibrator circuit. Zero drift is eliminated by a circuit, which, during the idling time between end-of-conversion and start-conversion, stores the accumulated offsets on the auto zero capacitor, to be used as a datum reference during the succeeding conversion.

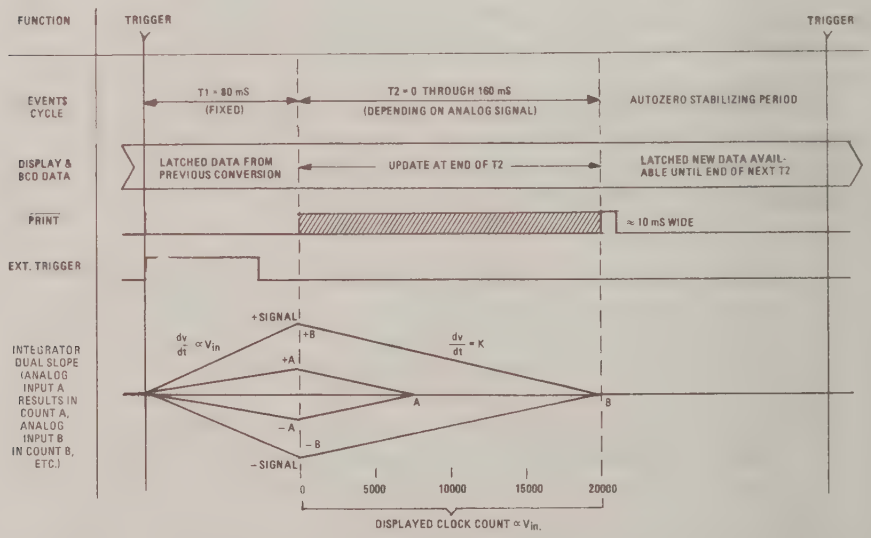


Figure 4. Timing Diagram

BLOCK DIAGRAM (Refer to Timing Diagram, System & Circuit Schematics)

The analog input is applied via the normal mode filter and overvoltage protection circuits to a switch. Upon receipt of a start pulse either from the internal rate multivibrator or from an external trigger, this switch connects the filter output to the integrator. At the end of T1 the switch replaces the analog signal with the reference, as an input to the integrator. At the end of T2 the switch grounds the input of the integrator and auto zero settling time commences. The requirement for a bipolar reference is avoided by charging the reference capacitor in a single polarity and then connecting it in the circuit reversed, when so required, by the polarity sensing logic. Also at the end of T2, the data latches are strobed and the accumulated T2 count entered.

The latch contents are presented in multiplexed 1-2-4-8 BCD format to the decoder, which in turn drives the seven segment light emitting diode displays.

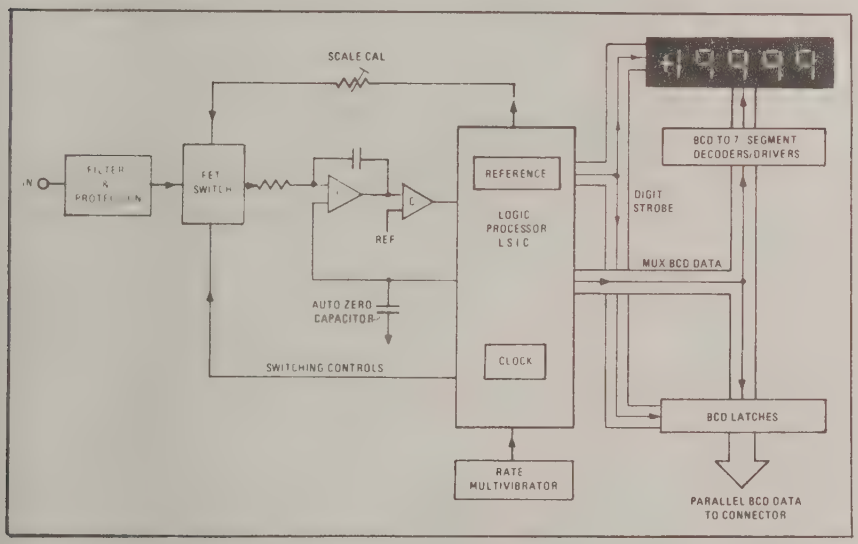


Figure 5. System Block Diagram

FACTORY REPAIR

Data Tech maintains a factory repair facility. Our trained technicians are available to repair your instruments with a minimum of inconvenience to you. Refer to the customer service card inside the back cover for equipment return instructions.

SPECIAL MODIFICATIONS

(To be filled in when units are modified)

Description of Modification(s)

Changes in specified Operation(s)

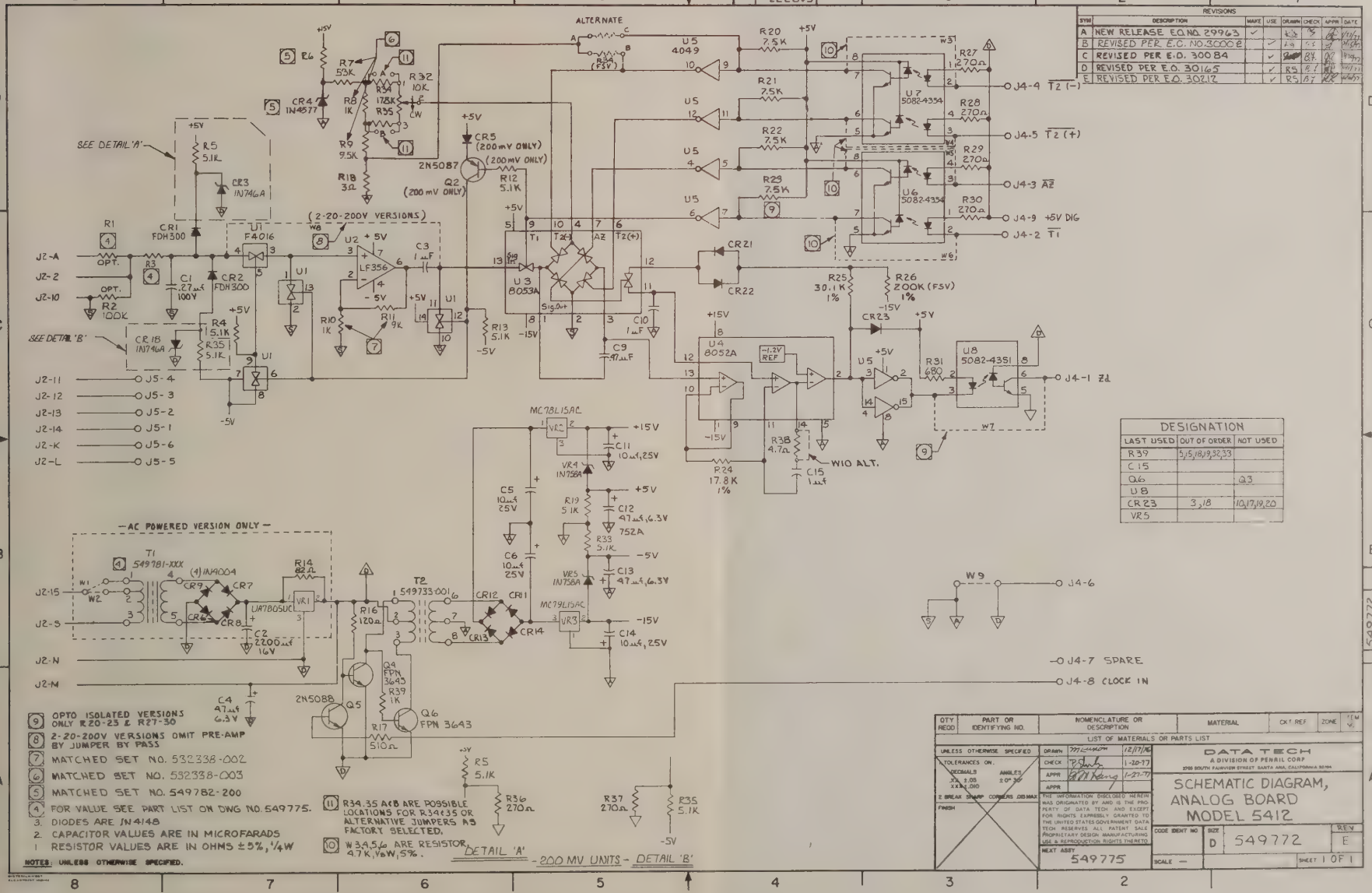
Drawings applicable to Modification(s)

Model 5412 Schematics

549772 Schematic Diagram - Analog Board

549773 Schematic Diagram - Digital Board

549774 Schematic Diagram - Display Board (LED)



REVISIONS						
SYM	DESCRIPTION	MAKE	USE	DRAWN	CHECK	APPR	DATE
A	NEW RELEASE E.O. NO. 29963	✓					
B	REVISED PER E.C. NO. 30002		✓				
C	REVISED PER E.O. 30084		✓				
D	REVISED PER E.O. 30165		✓	RS	AT		
E	REVISED PER E.O. 30212		✓	RS	AT		

DESIGNATION		
LAST USED	OUT OF ORDER	NOT USED
R39	5,15,18,19,32,33	
C15		
Q6		Q3
U8		
CR23	3,18	10,17,19,20
VR5		

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	CKT REF	ZONE	ITEM NO.

LIST OF MATERIALS OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
TOLERANCES ON:
DECIMALS: XX ±.05, XXX ±.010
ANGLES ±0° 30'
2 BREAK SHARP CORNERS .005 MAX
FINISH

DRAWN	[illegible]	12/17/76
CHECK	[illegible]	1-20-77
APPR	[illegible]	1-27-77
APPR		

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NEXT ASSY: 549775

DATA TECH
A DIVISION OF PENRIL CORP
2700 SOUTH FAIRVIEW STREET SANTA ANA, CALIFORNIA 92704

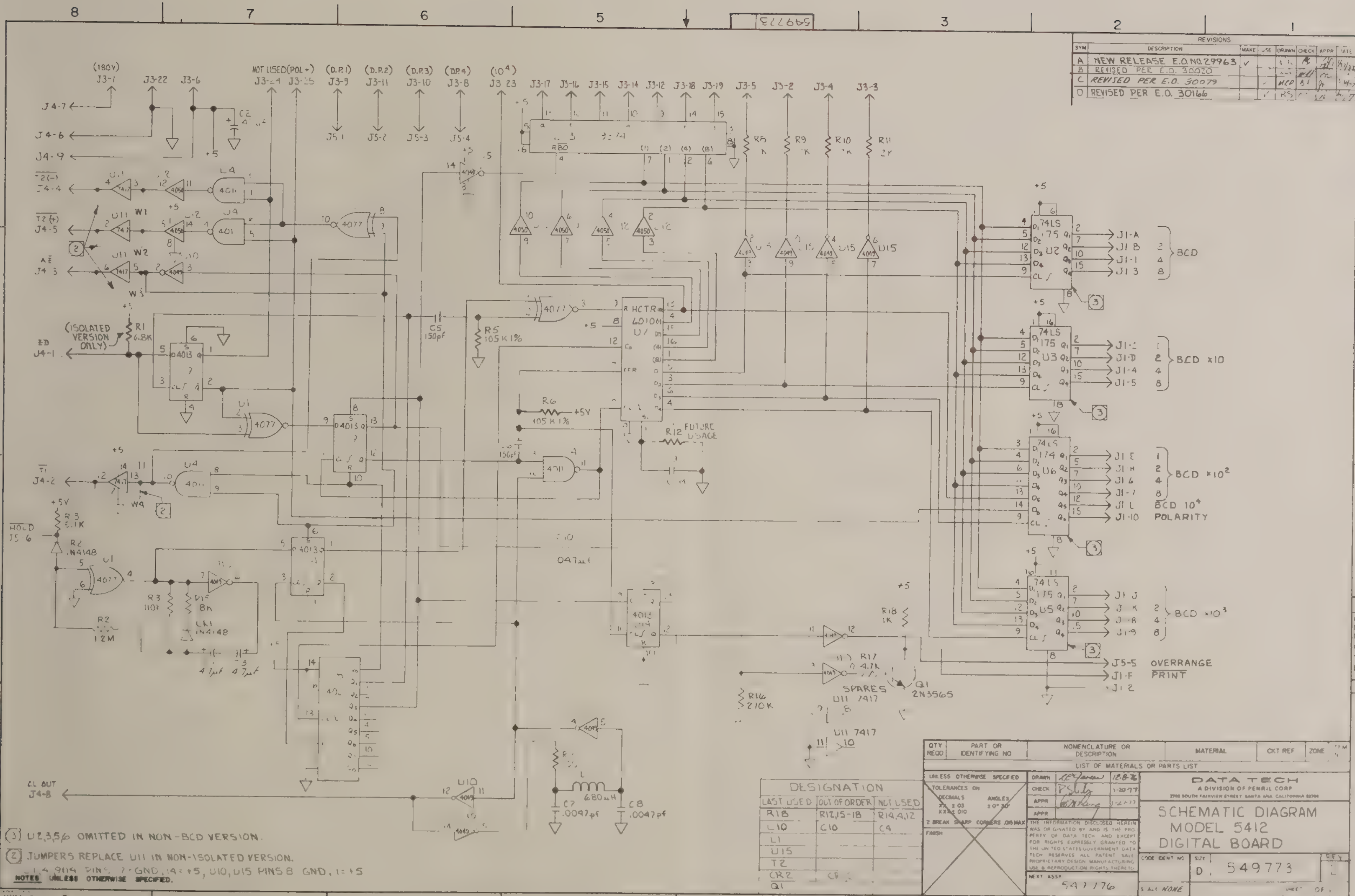
SCHEMATIC DIAGRAM, ANALOG BOARD MODEL 5412

CODE IDENT NO	SIZE	DWG NO	REV
	D	549772	E

SCALE —
SHEET 1 OF 1

549772

NOTES: UNLESS OTHERWISE SPECIFIED.
1. RESISTOR VALUES ARE IN OHMS ±5%, 1/4W
2. CAPACITOR VALUES ARE IN MICROFARADS
3. DIODES ARE 1N4148
4. FOR VALUE SEE PART LIST ON DWG NO. 549775.
5. MATCHED SET NO. 532338-002
6. MATCHED SET NO. 532338-003
7. MATCHED SET NO. 549782-200
8. 2-20-200V VERSIONS OMIT PRE-AMP BY JUMPER BY PASS
9. OPTO ISOLATED VERSIONS ONLY R20-25 & R27-30
10. W3,4,5,6 ARE RESISTOR, 4.7K, 1/8W, 5%.
11. R34,35 A&B ARE POSSIBLE LOCATIONS FOR R34<35 OR ALTERNATIVE JUMPERS AS FACTORY SELECTED.



SYM	DESCRIPTION	MAKE	USE	DRAWN	CHECK	APPR	DATE
A	NEW RELEASE E.O. NO. 29963	✓		[illegible]	[illegible]	[illegible]	[illegible]
B	REVISED PER E.O. 30020			[illegible]	[illegible]	[illegible]	[illegible]
C	REVISED PER E.O. 30079		✓	MCD	[illegible]	[illegible]	[illegible]
D	REVISED PER E.O. 30166		✓	RS	[illegible]	[illegible]	[illegible]

③ U2,3,5,6 OMITTED IN NON-BCD VERSION.

② JUMPERS REPLACE U11 IN NON-ISOLATED VERSION.

U1,4, 9114 PINS 7=GND, 14=+5, U10, U15 PINS 8 GND, 1=+5

NOTES UNLESS OTHERWISE SPECIFIED.

DESIGNATION

LAST USED	OUT OF ORDER	NOT USED
R18	R12,15-18	R14,4,12
C10	C10	C4
L1		
U15		
T2		
CR2	CR [illegible]	
Q1		

QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	CKT REF	ZONE	ITEM

LIST OF MATERIALS OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
TOLERANCES ON DECIMALS XX ±.03 XXX ±.010 ANGLES ±0° 30'
2 BREAK SHARP CORNERS .015 MAX
FINISH

DRAWN	[illegible]	12-8-76
CHECK	[illegible]	1-20-77
APPR	[illegible]	1-2[illegible]-77
APPR		

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NEXT ASSY 547176

DATA TECH
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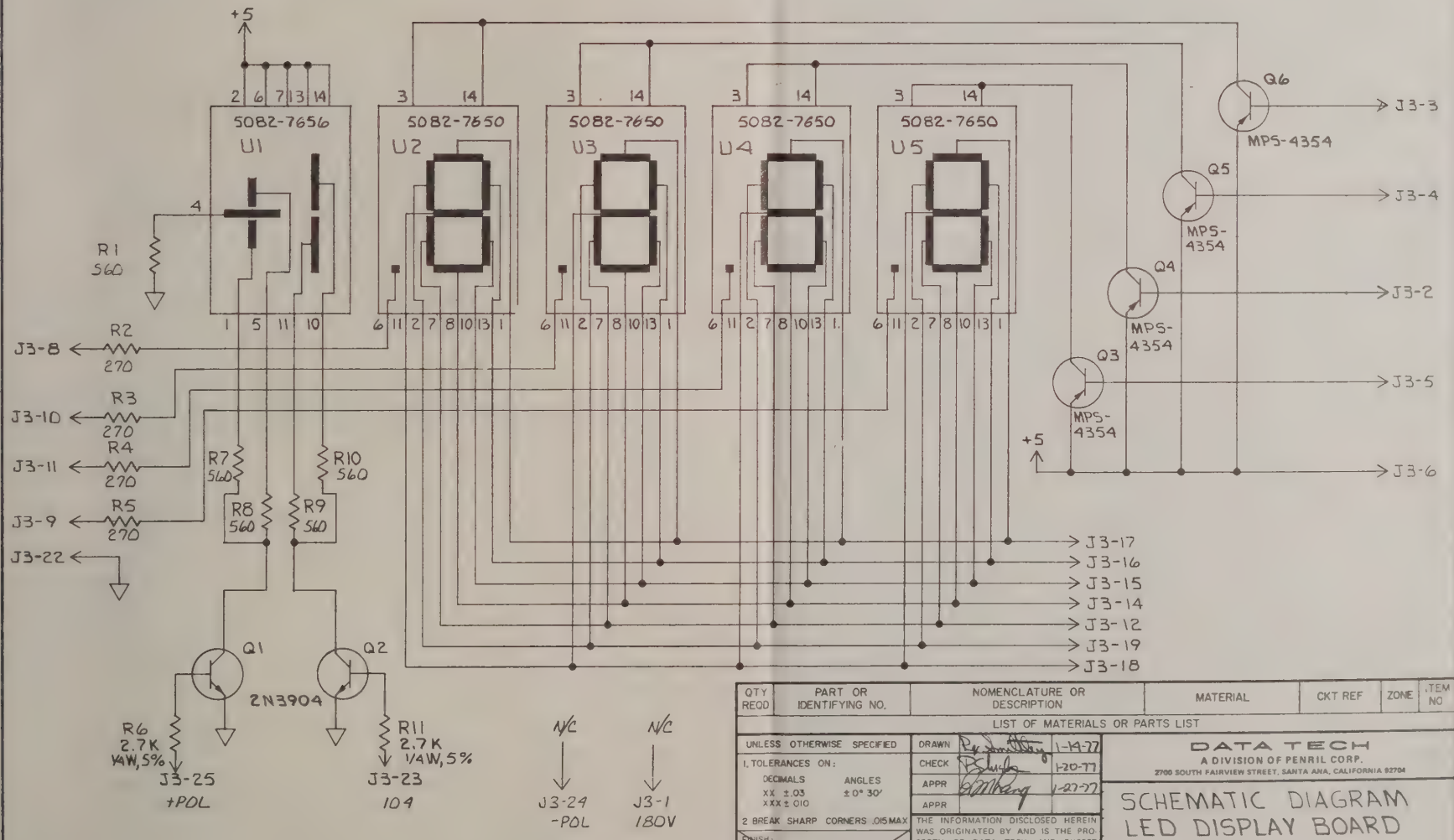
2700 SOUTH FAIRVIEW STREET SANTA ANA CALIFORNIA 92704

SCHEMATIC DIAGRAM
MODEL 5412
DIGITAL BOARD

CODE IDENT NO | SIZE D | 549773 | REV
SCALE NONE | SHEET OF

REVISIONS							
SYM	DESCRIPTION	MAKE	USE	DRAWN	CHECK	APPR	DATE
A	NEW RELEASE E.O. NO 29963	✓		RS	BT	GR	1/21/77
B	REVISED PER E.O. NO. 30018			R.S.	B.T.	GR	3/1/77
C	REVISED PER E.O. NO. 30055			L.G.	B.T.	GR	5-6-7



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	CKT REF	ZONE	ITEM NO

LIST OF MATERIALS OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES ON:
DECIMALS: XX ±.03, XXX ±.010
ANGLES ±0° 30'
2 BREAK SHARP CORNERS .015 MAX
FINISH

DRAWN		1-19-77
CHECK		1-20-77
APPR		1-27-77
APPR		

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2700 SOUTH FAIRVIEW STREET, SANTA ANA, CALIFORNIA 92704

SCHEMATIC DIAGRAM LED DISPLAY BOARD MODEL 5412

CODE IDENT NO.	SIZE	549774	REV
	C		C
SCALE NONE			SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED.

DIETZGEN POST CLEARPRINT 1000-18

COMPLETE AND AFFIX THIS CARD TO AN ASSEMBLY BEING RETURNED TO THE FACTORY.

Send it to:

DATA TECH, 2700 South Fairview Street, Santa Ana, California 92704
Attention: Product Service

Equipment:

Model _____ Serial Number _____ Purchase Date _____

Original P/O Number _____ Repair P/O Number _____

REASON FOR RETURN/MALFUNCTION SYMPTOMS: _____

_____

_____

After repair, please return this unit to:

_____

_____

_____

Bill non-warranty repairs to:

_____

_____

_____

Non-warranty repairs authorized if not to exceed $_____

Authorized by _____ Telephone No. (____)_____

This card provides a means of expanding communications between Data Tech and its customers. Entries aid Data Tech in selecting programs which are consistant with customer requirements. Your efforts are, therefore, very much sought and appreciated.

Name _____ Address _____

City _____ State _____ Zip Code _____

Model _____ Repeat Customer: Yes _____ No _____

Delivery: Good ____ Satisfactory ____ Poor ____ Manual: Good ____ Satisfactory ____ Poor ____

Appearance: Attractive ____ Needs Improvement ____

Who/What introduced Data Technology: Rep ____ Ad ____ Other ____

Additional features desired: _____

_____

Best liked features: _____

Application: _____

_____

Comments/Suggestions: _____

_____

_____

_____

Enclose with return equipment

Do not mail separately

FIRST CLASS
PERMIT NO. 4314
SANTA ANA, CALIF.
92704

BUSINESS REPLY MAIL

No Postage Necessary If Mailed In The United States

Postage will be paid by:

Data Tech
2700 South Fairview Avenue
Santa Ana, California 92704

Attention: Marketing Services

Printed in USA

MP MASTER

MA25737